in the torque thereof occurs. As is well known, fly ash is a substance of flow properties substantially similar to those of rheological liquids. This is the main reason for the failure of prior art devices attempting compaction of such materials by vibration or heat treatment. Neither the '338 patent to Peltonen et al. Nor the '202 patent to Roycraft nor the '967 patent to Kinoshita can in any reasonable manner be said to contain any teaching which would have enabled a person skilled in the art at the time of the instant invention to come up with anything resembling the invention in both its apparatus and method aspects.

In fact the instant invention is the result of many years' experimentation by Applicants to find an operable solution which can be practiced at reasonable cost and relatively low complexity. Applicants realized that in the case of the materials under consideration only those compactions are reproducible which approach the specific densest packings i.e. those of minimum voids. Only after extended trials and experimentation were Applicants able to conclude that the prior art methods of vibration cannot yield the desired reproducible and predictable compaction of these materials because of their properties vary widely depending upon their originating combustion materials and the combustion process.

Kinoshita's teaching of stopping a feed auger at a predetermined torque teaches nothing about obtaining samples of compacted grainy and dry material which would yield precise data of residual carbon content by way of electrical parameters. Any allegation that Peltonen, Roycraft and Kinoshita, singly or in any conceivable combination, anticipate or at least render obvious the instant invention would clearly carry reason beyond tolerable limits.

It is, therefore, earnestly urged that Applicants' invention is novel and unobvious over the prior art relied upon by the Examiner and that withdrawal of the Examiner's allegations is indicated and that the instant application as

amended may proceed to allowance which is courteously solicited.

Having regard to the objection against the sole drawing because reference numeral 3 has been referred to at page 7, lines 10 and 13 as a complex electrical component and a measuring chamber, respectively, the Examiner's attention is respectfully directed to lines 1 and 2 of page 7 where it is stated that the complex electrical component 3 is constituted as an enclosed measuring chamber. It would thus seem that there is no need for a corrected drawing.

The proposed corrections to the specification are to eliminate certain syntactical and typographical errors. Fresh pages of the specification and claims showing the corrections and amendments with and without amendatory markings are enclosed.

No additional fees are due.

Respectfully submitted,

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Enclosures
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Karl Hormann
Date: 14 September 2003

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

Application No.: 10/068,577
Filed: 5 February 2002
By: Conrads et al.
For: Method and Apparatus for Producing Samples from Mainly Granular and Dry Material

Examiner: Jackson, Andre K.
Group Art Unit: 2856

Replacement Pages of Specification and Claims
***with* Amendatory Markings**

hand, for controlling and optimizing the combustion process, i.e., for use of as much of the energy as is contained in the fuel. On the other hand, defining residual carbon content is necessary for controlling the quality of fly ash to be used as an additive in building materials and cement. Under both aspects, the invention aims at providing as low a residual carbon content, or as low a proportion of uncombusted components, as possible. Changing load conditions in a firing plant and different fuel compounds require constant monitoring of the combustion process which, in turn, leads to the requirement of continuously defining the residual carbon content or periodically to define it in short intervals of time or with no or very little time lag.

2. Statement of the Prior Art.

At present, the method employed by power plants is to draw samples followed by an analytic examination of the samples in a laboratory. This is ~~not only~~ expensive and results in such significant losses of time that for all intents and purposes it is impossible to optimize the combustion process.

For that reason efforts have not been wanting to develop methods and apparatus which make it possible to define residual carbon content in a simple manner, continuously or periodically, without any loss of time. In this connection, those methods have been found to be particularly suitable which are based upon a change in the electrical parameters of complex electric components which contain the fly ash to be measured. However, the handling of fly ash is extremely difficult because of its extremely complicated bulk behavior.

German Laid-Open Patent Specification No. DE-OS 33 03 177 disclosed a method and an apparatus for measuring the carbon content of fly ash in which the capacity of a capacitor is evaluated into which a sample of fly ash is

OBJECTS OF THE INVENTION.

It is an object of the invention to provide a method and an apparatus for producing samples of substantially finely granulated and dry materials.

A more particular object resides in the provision of a method and an apparatus for producing a sample of fly ash for determining its residual carbon content by defining changes in electrical parameters of a complex electrical component in which the sample to be examined is contained.

It is a further object of the invention to provide a method and an apparatus of the kind referred to which is of comparatively insignificant complexity.

A still further object of the invention is to provide a simple method and an apparatus for furnishing measuring results of high accuracy.

SUMMARY OF THE INVENTION.

These and other objects of the invention are accomplished by apparatus of the kind to be described. It is provided with a feed screw and a measuring chamber connected therewith. The measuring chamber is a complex electrical component into which fly ash is fed and compacted by the conveyor screw. Compaction of the chiefly finely granulated and dry material, i.e. fly ash, continues until the occurrence of an abrupt increase in the compaction force.

The hitherto practiced method of vibratory compaction of fly ash has been found not to yield reproducible results. Rather, in consequence of the vibration the fly ash remains in a fluidized condition. Moreover, the vibration has been found to result in demixing or segregation of the different components of the fly

ash. In the known methods and apparatus for producing samples of fly ash to measure their residual carbon content, the non-reproducible compaction results as well as, in particular, the apparent segregation lead to vastly scattered measuring results. The results have been found to deviate by significantly more than ± .5 percent.

The method in accordance with the invention is based upon the recognition that during compaction of fly ash, ~~that~~ once a reproducible degree of compaction has been reached, there occurs an abrupt increase of the compaction force of more than 200 % without, however, yielding any increased degree of compaction. By evaluating this large and significant leap in the compaction force, compaction results may thus be attained in a simple manner which, by the measuring to be described, yield results of high accuracy and low scattering.

Placing the closed measuring chamber or complex electrical component and the feed screw into a container for receiving fly ash such that the feed screw conveys fly ash into the measuring chamber and compacts it until an abrupt increase in its torque occurs, has been found to be of particular advantage. By placing the complex electrical component in the fly ash receiving container, the temperature of the fly ash stays at the level of between about 60 °C and 90 °C normal in fly ash collection containers. Unlike the prior art methods and devices, this avoids the need for special means for heating the fly ash samples. The fly ash enters the measuring chamber over a short path and, after the measurement has been taken, ~~it~~ the ash can be returned to the collection container by reversing the rotations of the feed screw. Advantageously, the screw conveyor is provided with an upwardly open catch trough for catching fly ash newly entering the container. A catching device of this kind should especially be provided if the screw conveyor is mounted in the collection container such that it

is not always present in the pouring path of the fly ash.

Of course, the invention allows for the possibility of providing means for removing samples from the measuring chamber for external calibrating tests.

Aside from the precise results and insignificant scattering thereof achievable by practicing the method and utilizing the apparatus of the invention, its simplicity is considered to be of particular advantage. The apparatus consisting of the screw conveyor and complex electrical component measuring chamber as well as the method in accordance with the invention offer technical solutions which may be mastered without any problems and can be advantageously applied in many measuring situations for defining the residual carbon content of fly ash ~~be~~ by defining the change of electrical parameters of a complex electrical component in which the samples of fly ash are received.

DESCRIPTION OF THE DRAWING.

The novel features which are considered to be characteristic of the invention are set forth with particularity in the appended claims. The invention itself, however, in respect of its structure, construction and lay-out as well as manufacturing techniques, together with other objects and advantages thereof, will be best understood from the following description of preferred embodiments when read in connection with the appended single drawing, which is a side elevation in partial section of an apparatus for practicing the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT.

Fly ash is collected in a container one side wall 1 of which is shown in the drawing. The apparatus in accordance with the invention consists of a

screw conveyor 2 and of a complex electrical component 3 constituted as an enclosed measuring chamber. A feed screw 4 of the screw conveyor 2 rotates within a tube 5 which is provided with openings 6 at its front end as well as in its upper section. The openings 6 are adapted to take in as well as to discharge ~~of~~ fly ash. In the embodiment shown, the length and diameter of the screw conveyor are about 300 mm and about 40 mm, respectively. The upward openings 6 are about 60 mm long and extend around the circumference of the tube by about 40°. The feed screw 4 may be ~~reversible~~ reversibly driven by an electric motor 7 disposed at the exterior of the collection chamber. The complex electrical component 3 is mounted above the screw conveyor 2 and engages the side wall 1 of the collection container, the arrangement being such that fly ash may be conveyed by the feed screw 4 from the collection container into the measuring chamber 3, and *vice versa* by simple reversal of the rotations of the screw 4.

For taking samples, the apparatus is mounted on the side wall 1 of the collection container such that the screw conveyor 2 and the measuring chamber 3 are disposed within the collection chamber, preferably at a location which places them into the flow path of fly ash into the container. Fly ash enters the tube 5 of screw conveyor through its upper and front openings 6 whence it is fed to the measuring chamber of the complex electrical component 3 by rotating the screw 4 in the appropriate direction. While being fed into the measuring chamber 3, the fly ash is increasingly compacted therein. As soon as the torque of the feed screw 4 abruptly increases from about .1 Newtonmeter to about .3 Newtonmeter, the fly ash within the complex electric component 3 has reached a ~~defined~~ degree of compaction appropriate for defining the residual carbon content of the fly ash with sufficient accuracy by determining the change in the electrical parameters of the compact electric component 3. In the embodiment described the scattering of the measuring values or results is less than ± .2

What is claimed is:

1. (Currently amended) An apparatus for producing a sample of a mainly finely ~~drained~~ grained and dry material for defining the residual carbon content thereof ~~by defining~~ as a function of a change in at least one electrical parameter, comprising:

a measuring chamber;

a screw conveyor connected to the measuring chamber and comprising a rotatable feed screw;

means for rotating the feed screw at a predetermined torque for feeding the material to the measuring chamber ~~and~~ for ~~compacting the material~~ compaction therein; and

means responsive to an abrupt increase in the torque for stopping rotation of the feed screw.

2. (Original) The apparatus of claim 1, wherein the measuring chamber and the screw conveyor are positioned in a chamber for collecting the material.

3. (Original) The apparatus of claim 1, wherein the screw conveyor comprises a tubular member for rotatably receiving the feed screw and provided with at least one opening for receiving the material.

4. (Canceled) The apparatus of claim 1, further comprising means for monitoring the torque of the rotating feed screw.

5. (Canceled) The apparatus of claim 4, wherein the torque monitoring means comprises means responsive to abrupt increases of the torque for termination of rotation of the feed screw.

6. (Original) A method of producing samples of a mainly finely granulated and dry material for determining the residual carbon content of the material, comprising the steps of:

feeding the material at a predetermined force to a measuring chamber for compaction therein;

monitoring the force; and

interrupting the feeding of material at an abrupt increase in the force.

7. (Original) The method of claim 6, wherein the material is fed to the measuring chamber by a rotating conveyor screw and wherein the force is monitored as a function of the torque of the conveyor screw.

8. (Original) The method of claim 7, wherein feeding of the material is interrupted at an increase in torque by more than 200 percent.